

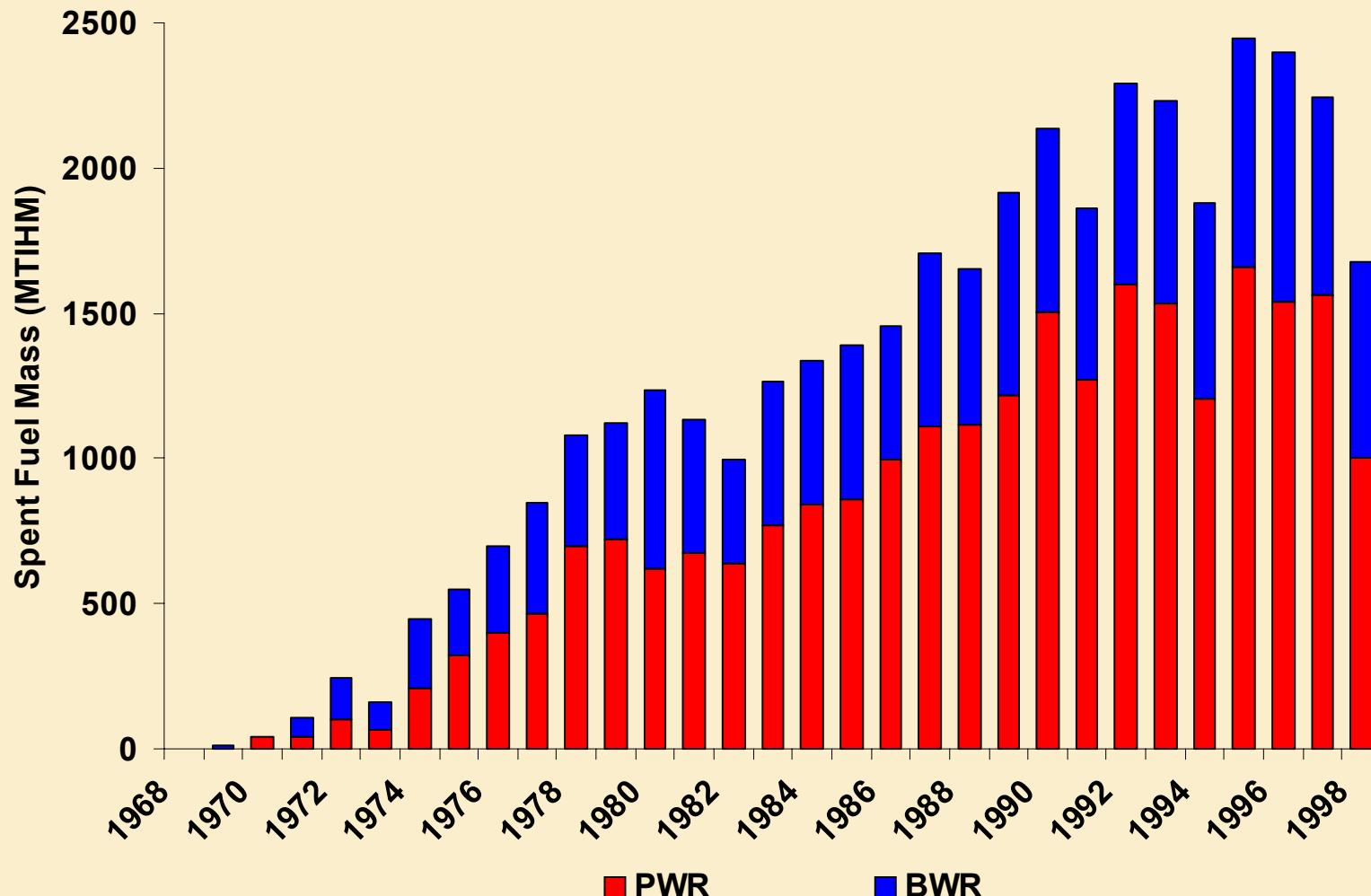
Pre-Conceptual Design: Spent Fuel Database Significant Issues and Conclusions

**G. D. DelCul,
B. B. Spencer, E. D. Collins,
C. W. Alexander, R. M. Canon**

January 22-24, 2003

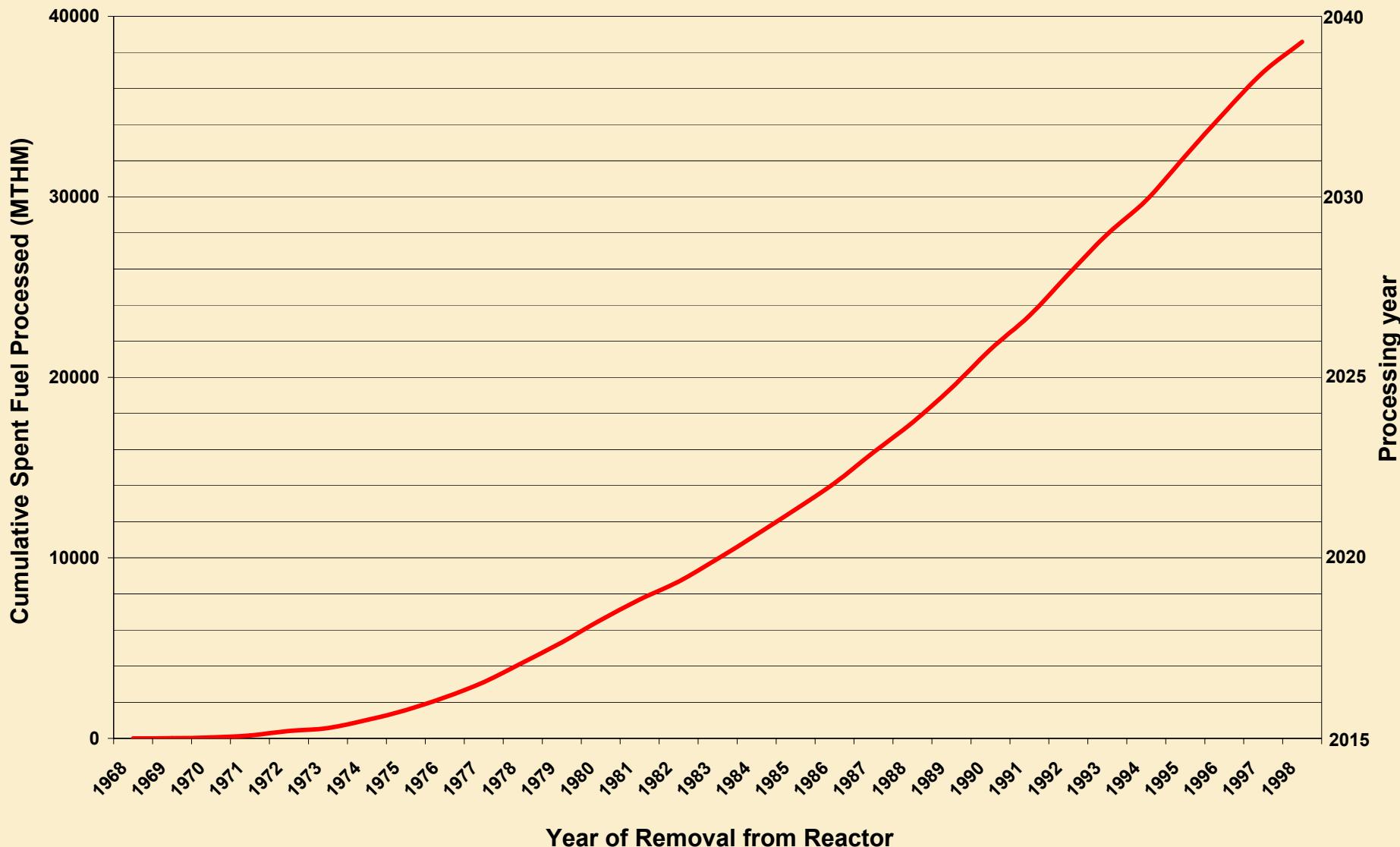
**Advanced Nuclear Fuel Cycle Program
Quarterly Review Meeting
Sheraton Hotel
Albuquerque, New Mexico**

Annual mass of spent fuel discharged



PWR 64% BWR 36% (avg. 1970-1998)

If processing “older fuel first”
 $SF \geq 34$ years old for the lifetime of the plant

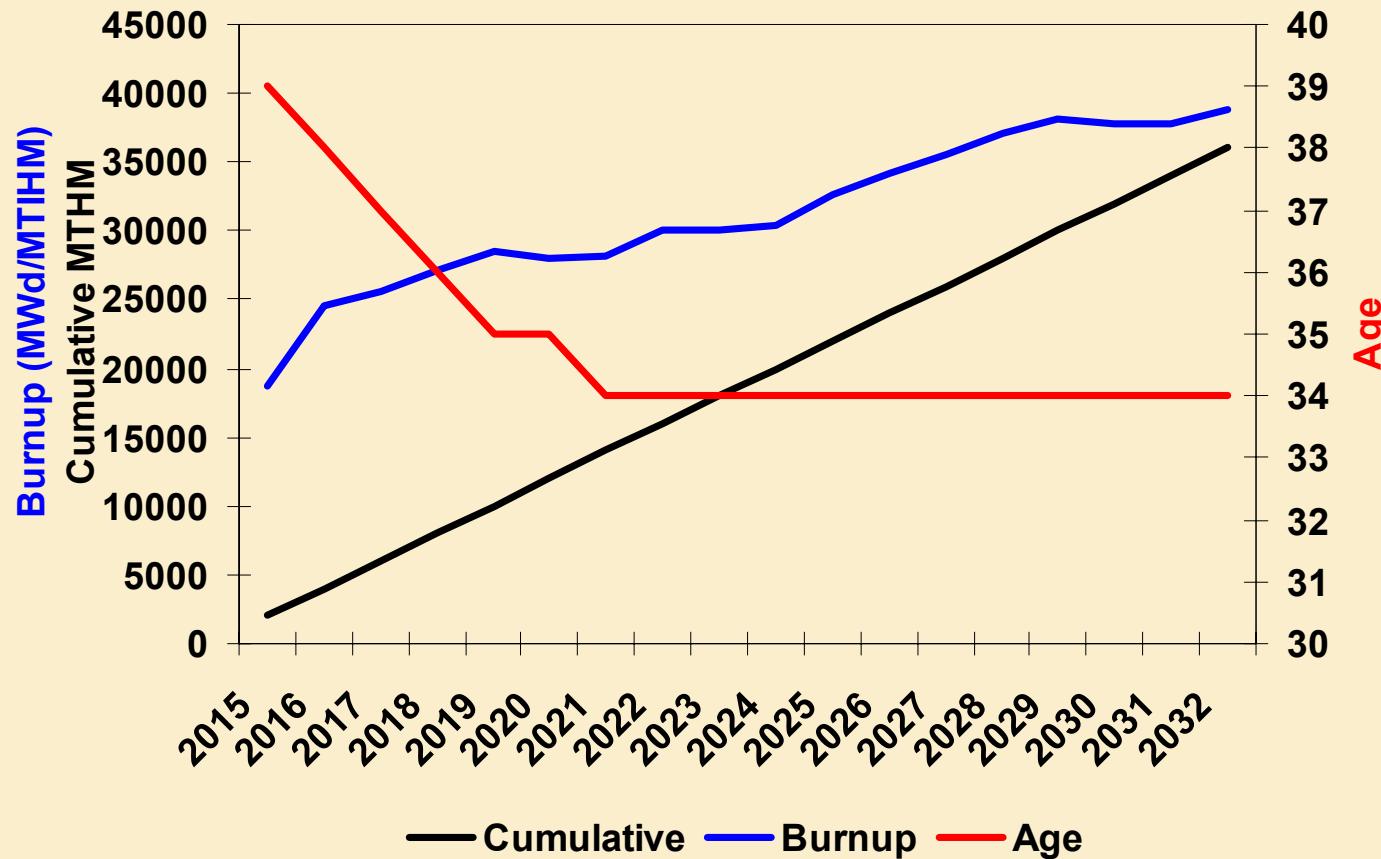


Lower burn-up fuel processed early, higher later

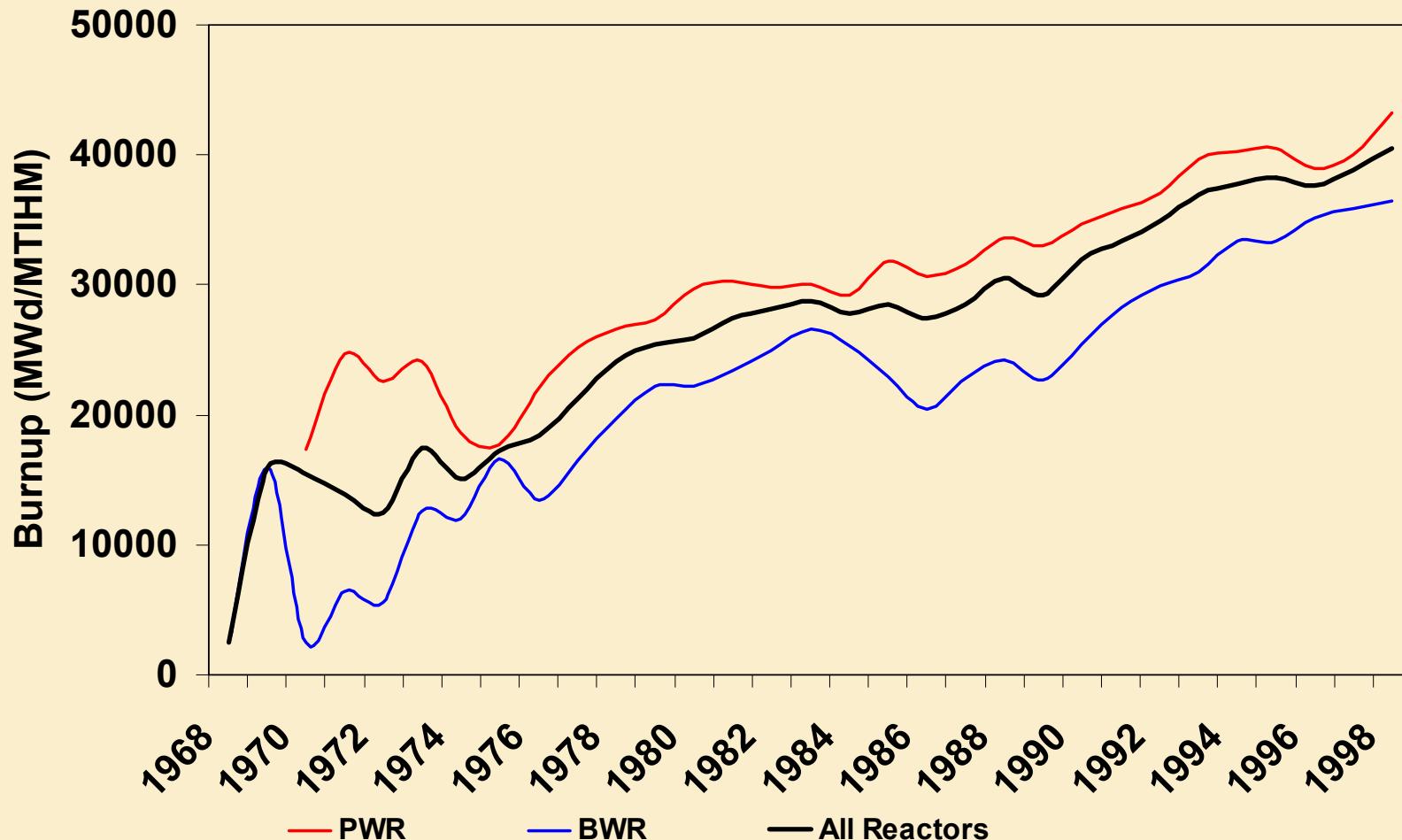
First 10 years <30000 MWd/MTIHM

Second 10 years <40000 MWd/MTIHM

A 30 year plant will process fuel generated during 1969-2009

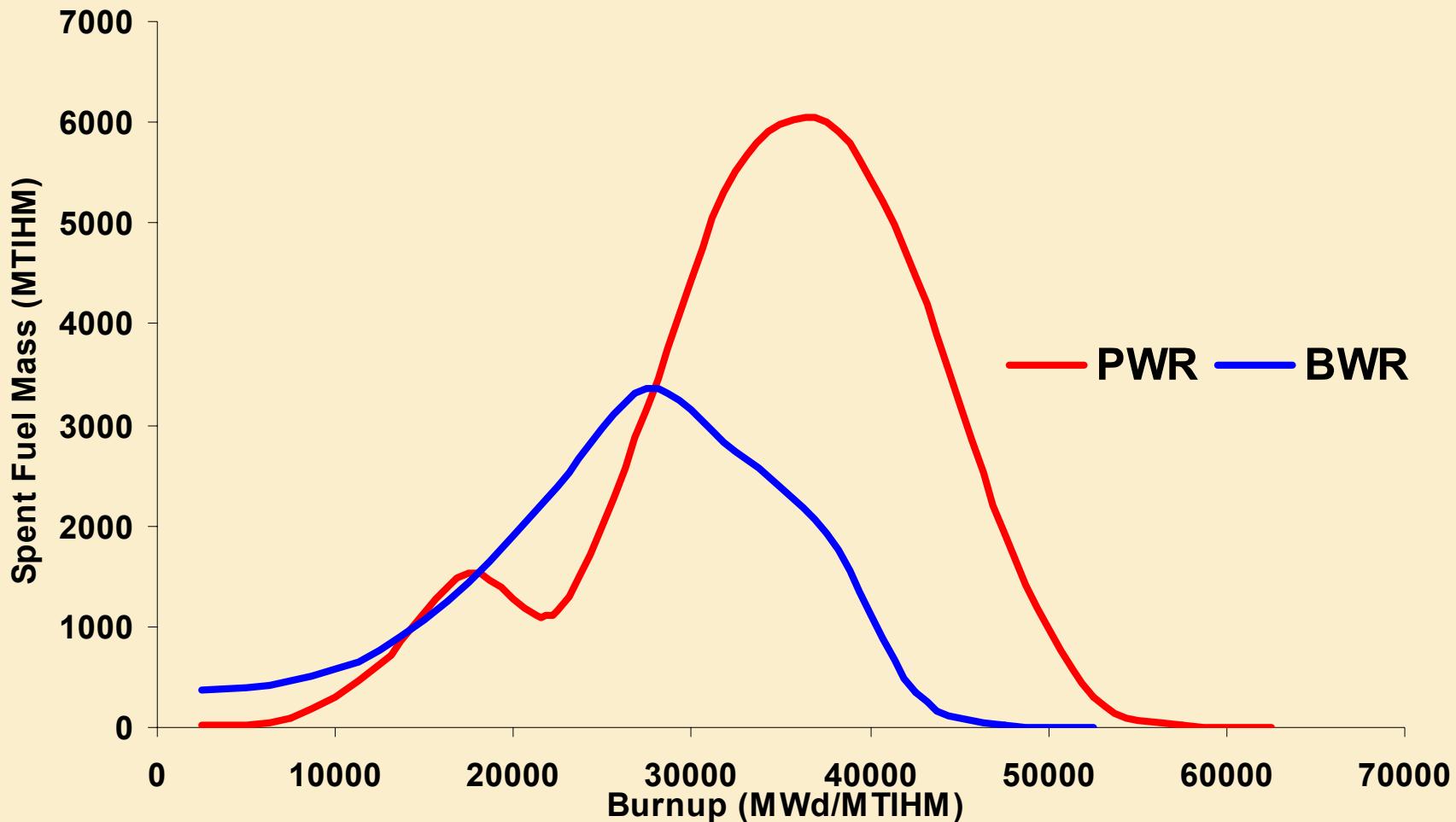


Average burnup for LWR spent fuel

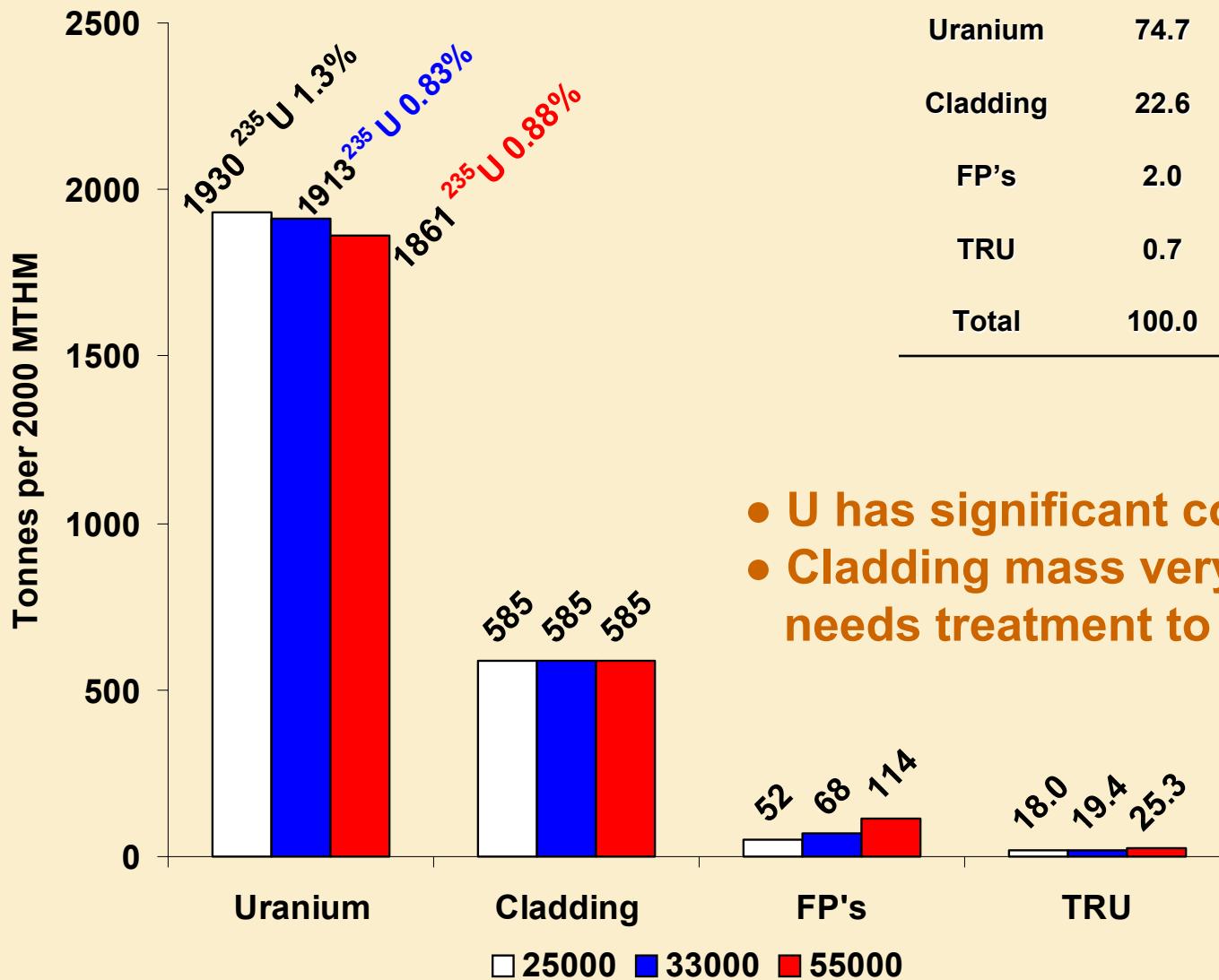


There are about 160000 spent fuel elements already in storage (135000 as of 1998) and about 6000 are generated every year

Cumulative 1970-1998
39000 tonnes of spent fuel
average burnup 31400 MWd/MTIHM



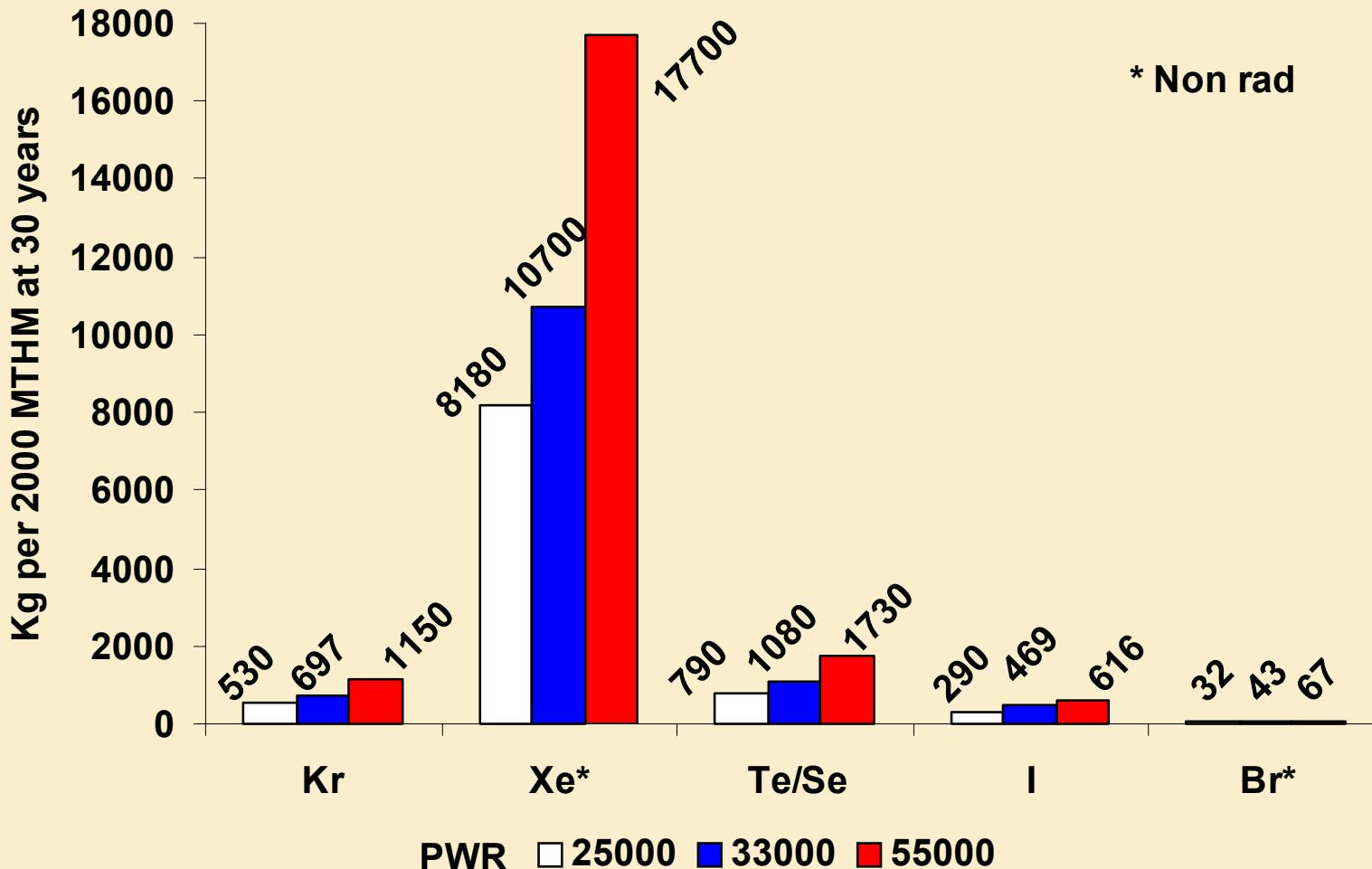
Global distribution in 2000 MTHM PWR SF



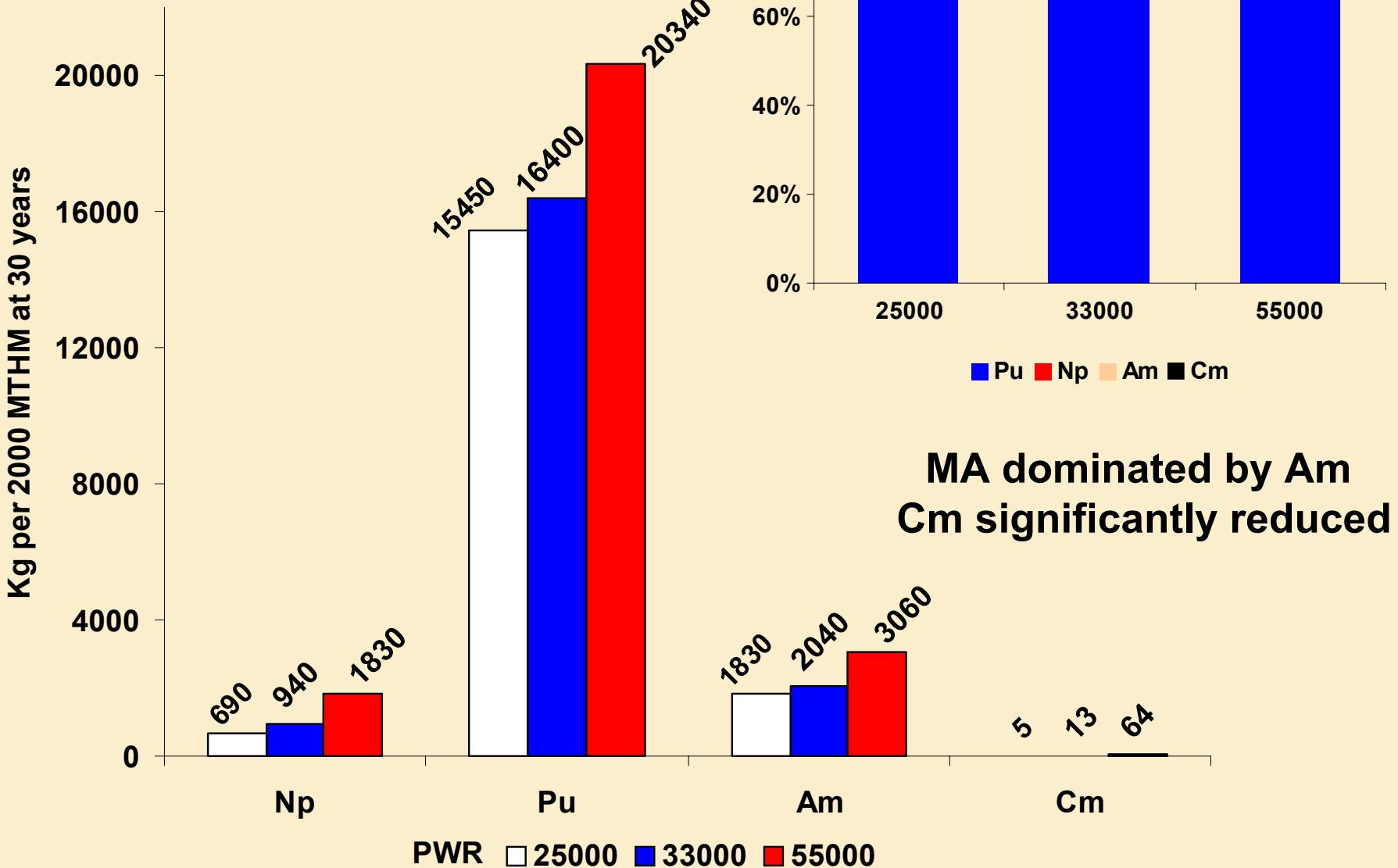
Fraction	PWR Fuel Burnup (MWd/MTIHM)		
	25000	33000	55000
Uranium	74.7	74.0	72.0
Cladding	22.6	22.6	22.6
FP's	2.0	2.6	4.4
TRU	0.7	0.8	1.0
Total	100.0	100.0	100.0

- U has significant commercial value
- Cladding mass very large, needs treatment to avoid repository

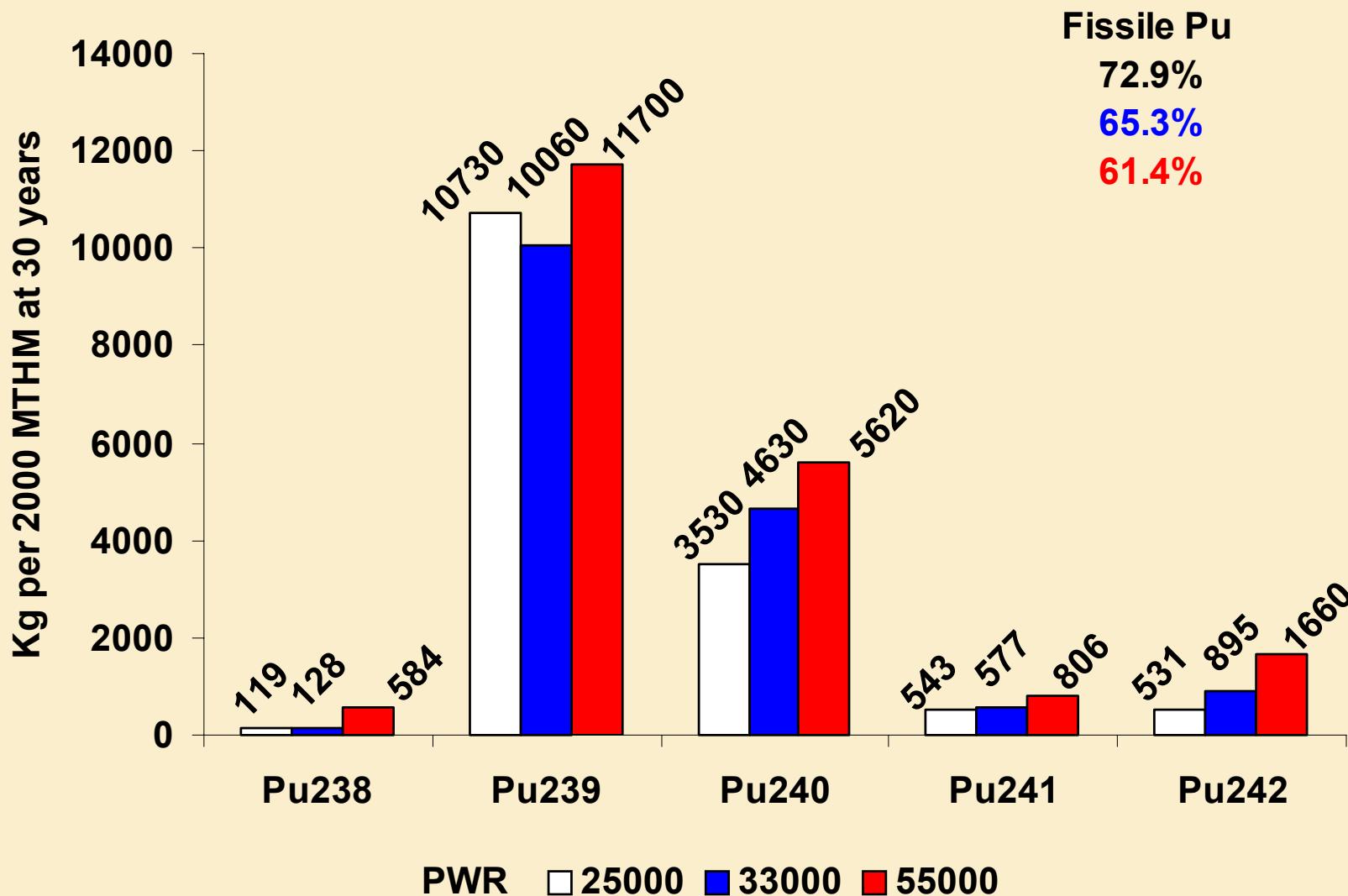
Volatile species represent about 19% of the FP's
Large amount of radionuclides. Thus, off-gas treatment must be
addressed. Near-zero emissions probably required



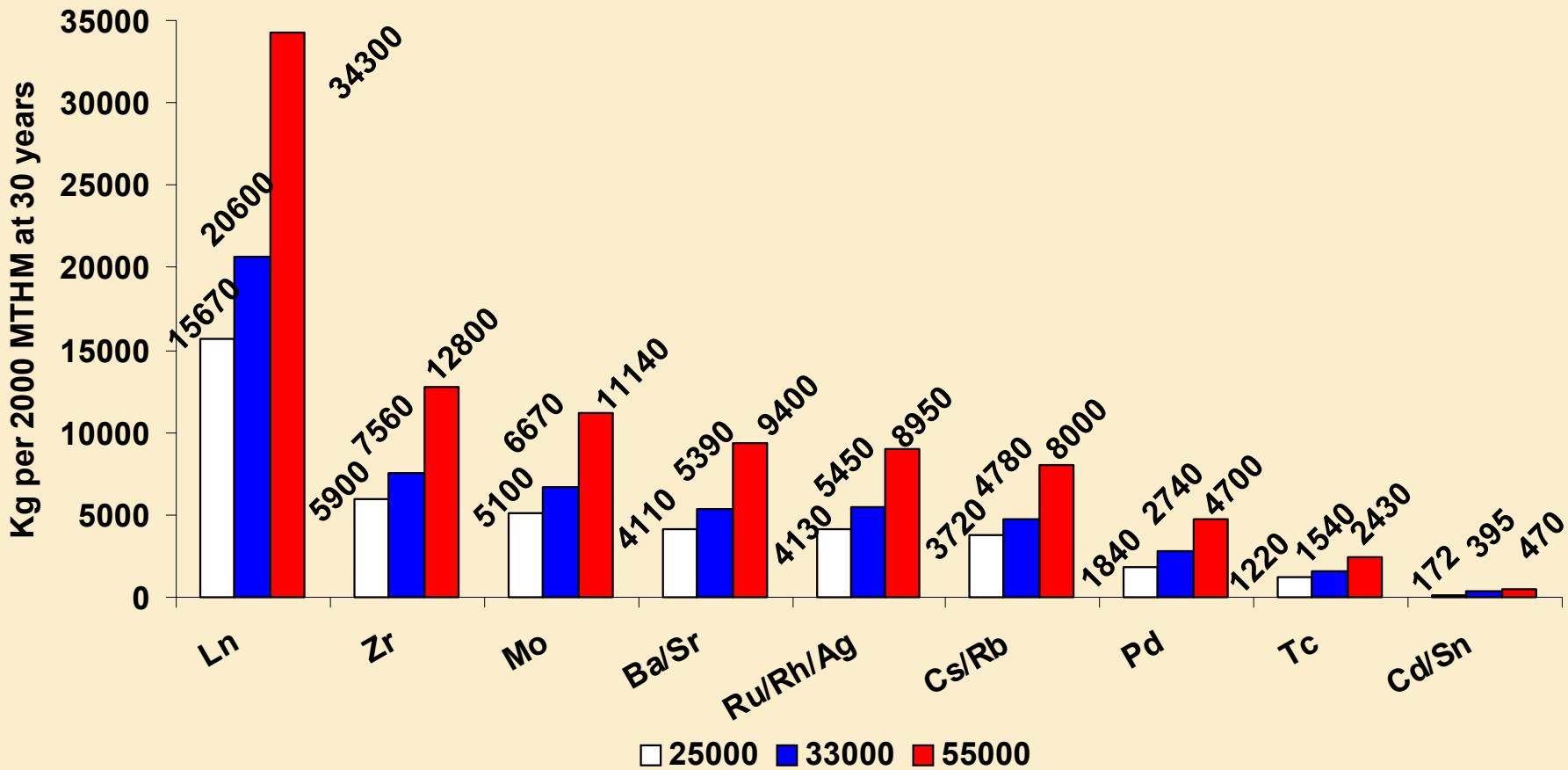
TRU content in 2000 MTHM PWR



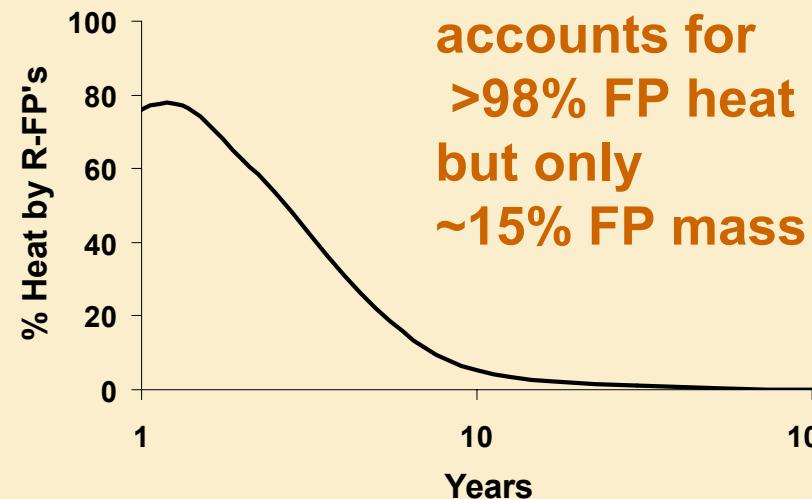
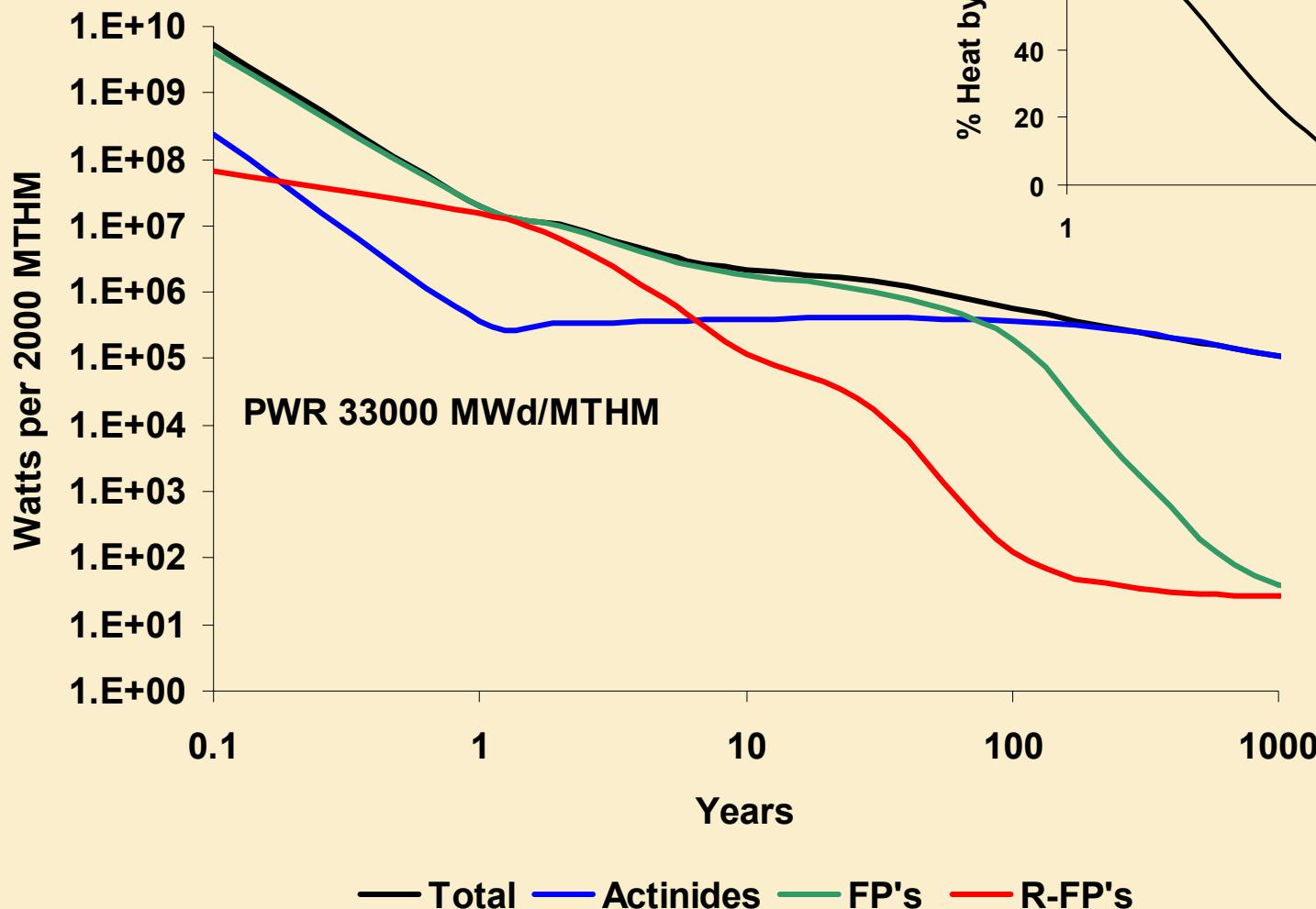
Pu content in 2000 MTHM PWR SF



Main fission products from 2000 MTHM after 30 years

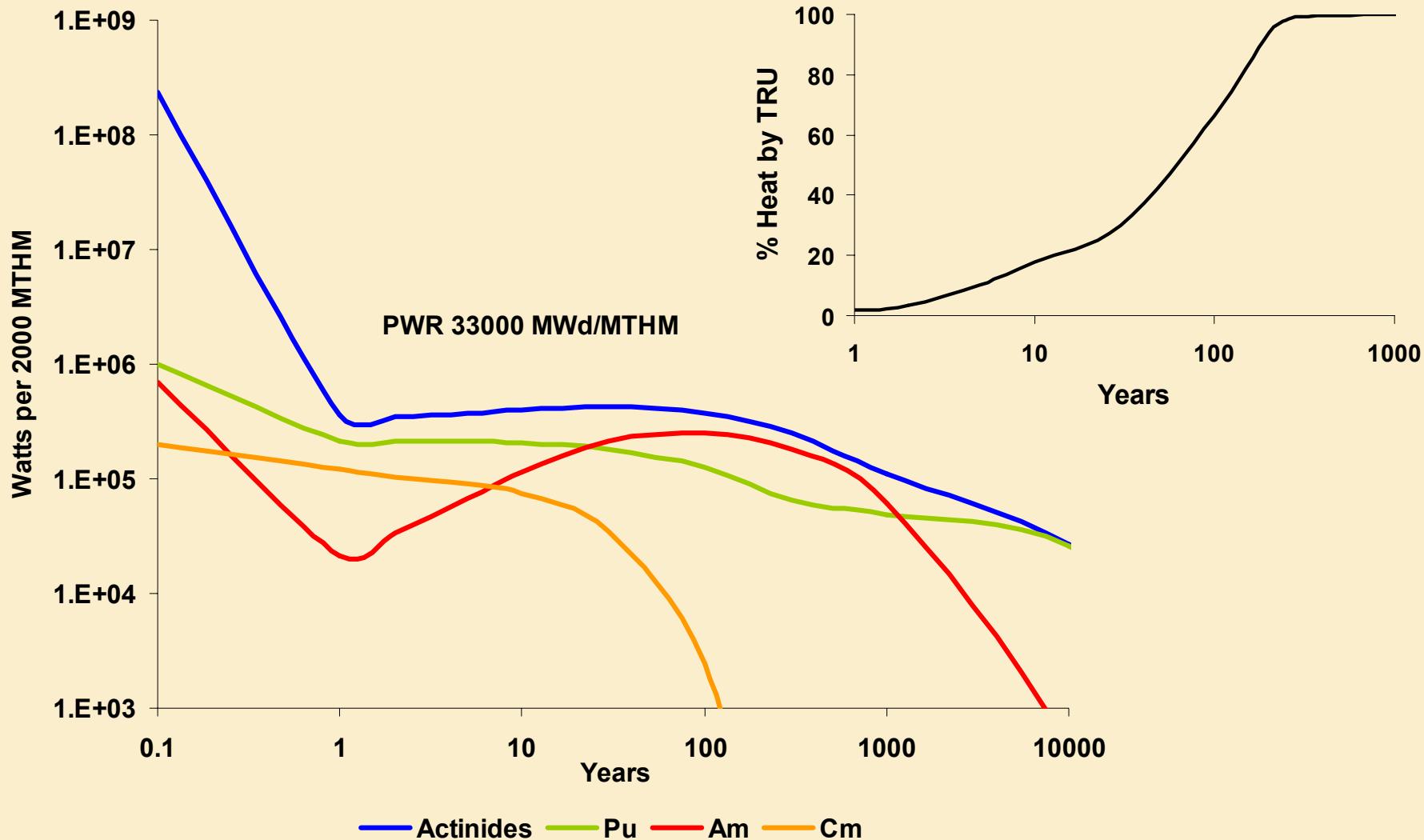


After processing,
the decay heat from the residual
FP's is very small



Cs and Sr
accounts for
>98% FP heat
but only
~15% FP mass

Heat Released by TRU



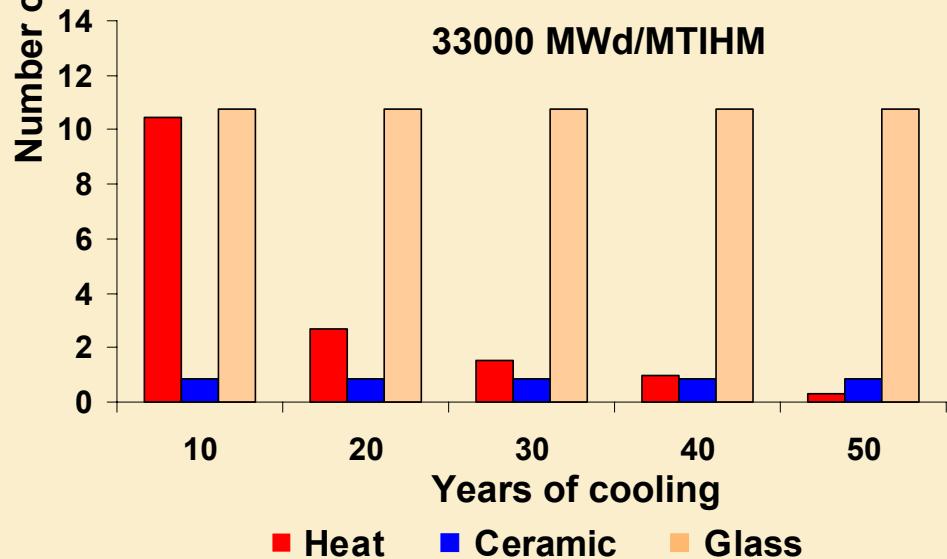
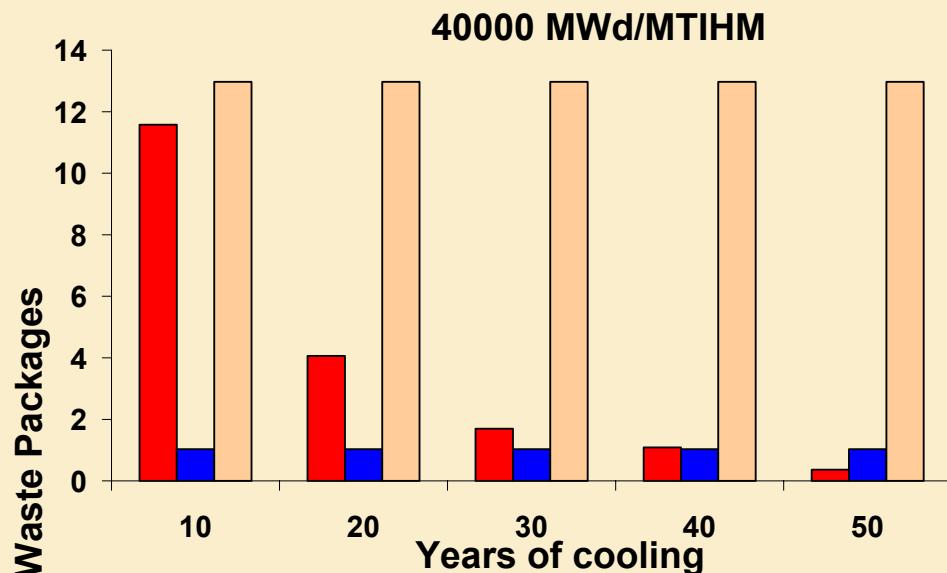
Number of waste Packages per 2000 tonnes of Residual Fission Products

200 waste packages are required for 2000 tonnes of spent fuel

1 waste package has a capacity of : 11 KW or 10 m³, or 10 tonnes of spent fuel

Cladding from 2000 tonnes of spent fuel requires about 12 waste packages

A 2000 tonnes plant would generate 16 to 32 waste packages of HLW glass



Conclusions

- Long cooled (~34 years) spent fuel can be fed to the processing plant during its lifetime.
 - Radiation fields and heat are significantly reduced
 - Lower separation efficiency is needed, thus reducing capital and operational costs
 - Lower waste disposal costs
- Processing capacity must address larger amount of U during early years and larger amounts of actinides and fission products in later years.